WHAT IS CLAIMED:

1. A method for the chemical reduction of metallic oxides comprising:

forming pellets of metallic oxide and particulate carbon;

providing an electrothermal fluidized bed furnace and establishing a fluidized bed of granular carbon therein;

heating the fluidized bed of granular carbon by passing electrical current through said fluidized bed;

introducing the pellets of metallic oxide and particulate carbon into the heated fluidized bed of granular carbon;

providing a fluidizing gas through the furnace at a flow rate sufficient to maintain the granular carbon and metallic oxide/particulate carbon pellets in the fluidized bed;

maintaining the fluidized bed at a temperature sufficient to cause a chemical reduction reaction of the metallic oxide and particulate carbon within the pellets;

removing the chemically reduced pellets from the furnace; and

exhausting effluent gases comprising fluidizing gas and gases resulting from the reduction reaction from the furnace.

2. The method of Claim 1 wherein the metallic oxide comprises metallic oxides that can be carbothermically reduced to a metallic phase in the presence of carbon below the melting point of the metal constituent of the metallic oxide.

3. The method of Claim 2 wherein the metallic oxides are selected from the group comprising iron ore, iron oxide, vanadium oxide, nickel oxide, tungsten oxide, cobalt oxide, and chromium oxide.

4. The method of Claim 1 wherein the fluidized bed is maintained at a temperature from 850°C to 1,100°C.

5. The method of Claim 1 wherein the metallic oxide/particulate carbon pellets are maintained in the fluidized bed for from 15 minutes to 60 minutes.

6. The method of Claim 1 further comprising separating the reduced pellets from any granular carbon removed from the furnace therewith.

7. The method of Claim 6 further comprising recycling the separated granular carbon by reintroducing it into the fluidized bed.

8. The method of Claim 1 wherein the fluidizing gas is selected from the group comprising nitrogen, carbon monoxide, hydrogen and natural gas.

9. The method of Claim 1 wherein the effluent gases are recycled to serve as the fluidizing gas.

10. The method of Claim 1 wherein the granular carbon of the fluidized bed is selected from the group comprising metallurgical coke, petroleum coke, coal and graphite.

11. The method of Claim 1 wherein the granular carbon is sized from 0.3 mm (+50 mesh) to 3.36 mm (-4 mesh).

12. The method of Claim 1 wherein the metallic oxide and particulate carbon both have a particle size of less than 150 μm (-100 mesh).

13. The method of Claim 1 wherein the metallic oxide and particulate carbon both have particle sizes of less than 100 μm (-150 mesh).

14. The method of Claim 1 wherein the particulate carbon in the pellets is from 22.5 wt.% to 28 wt.% of the metallic oxide.

15. The method of Claim 1 wherein the pellets are sized from 0.425 mm (+40 mesh) to 3.5 mm (-6 mesh).

16. The method of Claim 1 wherein the pressure within the fluidized bed is approximately equal to atmospheric pressure.

17. A free-flowing directly reduced granular iron pellet containing metallic iron dispersed within a matrix of partially reduced iron oxides and free carbon having a particle density within the range of 4.2 g/cc and 5.2 g/cc.

18. A method for the chemical reduction of metallic oxides comprising:

providing an electrothermal fluidized bed furnace and establishing a fluidized bed of granular carbon therein;

heating the fluidized bed of granular carbon by passing electrical current through said fluidized bed;

introducing fine particles of metallic oxide into the heated fluidized bed of granular carbon;

providing a fluidizing gas through the furnace at a flow rate sufficient to maintain the granular carbon and metallic oxide in the fluidized bed;

maintaining the fluidized bed at a temperature sufficient to cause a chemical reduction reaction of the metallic oxide and particulate carbon;

removing the chemically reduced metallic oxide from the furnace; and

exhausting effluent gases comprising fluidizing gas and gases resulting from the reduction reaction from the furnace.

19. The method of Claim 18 wherein the metallic oxide comprises metallic oxides that can be carbothermically reduced to a metallic phase in the presence of carbon below the melting point of the metal constituent of the metallic oxide.

20. The method of Claim 19 wherein the metallic oxides are selected from the group comprising iron ore, iron oxide, vanadium oxide, nickel oxide, tungsten oxide, cobalt oxide, and chromium oxide.

21. The method of Claim 18 wherein the fluidized bed is maintained at a temperature from 850°C to 1,100°C.

22. The method of Claim 18 wherein the metallic oxide is maintained in the fluidized bed for from 15 minutes to 60 minutes.

23. The method of Claim 18 further comprising separating the reduced metallic oxide from any granular carbon removed from the furnace therewith.

24. The method of Claim 23 further comprising recycling the separated granular carbon by reintroducing it into the fluidized bed.

25. The method of Claim 18 wherein the fluidizing gas is selected from the group comprising nitrogen, carbon monoxide, hydrogen and natural gas.

26. The method of Claim 18 wherein the effluent gases are recycled to serve as the fluidizing gas.

27. The method of Claim 18 wherein the granular carbon of the fluidized bed is selected from the group comprising metallurgical coke, petroleum coke, coal and graphite.

28. The method of Claim 18 wherein the granular carbon is sized from 0.3 mm (+50 mesh) to 3.36 mm (-4 mesh).

29. The method of Claim 18 wherein the metallic oxide has a particle size of less than 150 μm (-100 mesh).

30. The method of Claim 18 wherein the metallic oxide has a particle size of less than 100 μm (-150 mesh).

31. The method of Claim 18 wherein the pressure within the fluidized bed is approximately equal to atmospheric pressure.

32. The method of Claim 18 further comprising forming pellets of the fine particles of metallic oxide with particulate carbon prior to introduction into the heated fluidized bed.

33. The method of Claim 32 wherein the particulate carbon in the pellets is from 22.5 wt.% to 28 wt.% of the metallic oxide.

34. The method of Claim 32 wherein the pellets are sized from 0.425 mm (+40 mesh) to 3.5 mm (-6 mesh).

35. An electrothermal fluidized bed furnace comprising:

a furnace body defining a fluidized bed zone, an overbed zone disposed above the fluidized bed zone, and a discharge zone disposed below the fluidized bed zone, the fluidized bed zone comprising a first portion and a second portion disposed above the first portion and having a cross-sectional area larger than that of the first portion, the first portion defining a lower fluidizing zone and the second portion defining an upper fluidizing zone;

at least one electrode disposed generally centrally within the furnace body and extending into the upper fluidizing zone but not into the lower fluidizing zone;

at least one electrode secured to the wall of the second portion; and

a plurality of nozzles disposed at the bottom of the first portion for introducing fluidizing gas into the furnace.

36. The electrothermal fluidized bed furnace of Claim 35 wherein the first section comprises a conical section defining a central angle of from 30° to 90°.

37. The electrothermal fluidized bed furnace of Claim 35 wherein the first section comprises a conical section defining a central angle of from 40° to 60°.

38. The electrothermal fluidized bed furnace of Claim 35 wherein the cross-sectional area of the second portion is from 1.5 to 2.5 times larger than the cross-sectional area of the first portion.

39. The electrothermal fluidized bed furnace of Claim 35 wherein the first and second portions have circular cross-sections and the diameter of the second portion is from 1.5 to 2.5 times larger than the diameter of the first portion.